CLAIMS

WHAT IS CLAIMED IS:

An optical communication system comprising:

a transmitting station;

an optical transmission line for transmitting an optical signal sent from said transmitting station;

a receiving station for receiving said optical signal outputted from said optical transmission line;

a repeater station provided at one point or more in said optical transmission line; and

pump light sources provided in at least two of said transmitting station, said receiving station, and said repeater station, for supplying pump light to said optical transmission line, wherein

said pump light has two types or more of wavelengths.

2. The optical communication system according to claim 1, wherein

said optical transmission line has a Raman gain as a function of wavelength in which an interval between a minimum value and a maximum value of a wavelength of said pump light coincides with a width of an amplifying wavelength band

when a maximum value first appeared after a Raman gain generated by said pump light starts showing coincides with a center wavelength of the amplifying wavelength band to be amplified.

3. The optical communication system according to claim 1, wherein:

said pump light has a first wavelength and a second wavelength; and

said second wavelength is set so that a maximum value first appeared after a second Raman gain generated by said pump light with said second wavelength starts showing substantially coincides with

a local minimum value first appeared after a first Raman gain generated by said pump light with said first wavelength starts showing, on said first wavelength.

4. The optical communication system according to claim 1, further comprising:

shielding means provided in said optical transmission line inside a station, for shielding said pump light, the station opposing to another station supplied with said pump light, and being in a direction that said pump light transmits from said another station.

5. The optical communication system according to claim 1, further comprising:

residual light detecting means provided in a station, for detecting optical power of residual pump light of said pump light, the station opposing to another station supplied with said pump light, and being in a direction that said pump light transmits from said another station;

adjusting means provided in a station supplied with said pump light, for adjusting optical power of said pump light so that a detection result from said residual light detecting means falls within a predetermined fixed range; and

detection result transmitting means for transmitting said detection result from said residual light detecting means to said adjusting means.

6. The optical communication system according to claim 1, further comprising:

residual light detecting means provided in a station for detecting optical power of residual pump light of said pump light, the station opposing to another station supplied with said pump light, and being in a direction that said pump light transmits from said another station;

stopping means provided in a station supplied with said pump light, for stopping supply of said pump light when a detection result from said residual light detecting means is equal to or lower than a predetermined value; and

detection result transmitting means for transmitting said detection result from said

residual light detecting means to said stopping means.

7. The optical communication system according to claim 1, further comprising:

optical signal detecting means provided in a station supplied with said pump light, for detecting optical power of said optical signal; and

stopping means for stopping supply of said pump light when a detection result from said optical signal detecting means is outside a predetermined fixed range.

8. The optical communication system according to claim 1, further comprising:

reflected light detecting means provided in a station supplied with said pump light, for detecting optical power of reflected pump light of said pump light; and

stopping means for stopping supply of said pump light when a detection result from said reflected light detecting means is equal to or higher than a predetermined value.

9. The optical communication system according to claim 8, further comprising superimposing means for superimposing a low frequency on said pump light, and wherein

said stopping means detects said low frequency to verify said pump light.

10. The optical communication system according to claim 1, further comprising detecting means provided in a station according to a pumping method of said pump light, for detecting optical power of said optical signal amplified by said pump light; and

stopping means provided in a station supplied with said pump light, for stopping supply of said pump light when a comparison result between first and second detection results is within a predetermined range, the first detection result being obtained by said detecting means when a pump light having a first optical power is supplied to said power transmission line, the second detection result being obtained by said detecting means when a pump light having a second optical power larger than said first optical power is supplied to said optical transmission line.

11. An optical communication system comprising:

a transmitting station;

an optical transmission line for transmitting an optical signal sent from said transmitting station;

a receiving station for receiving said optical signal outputted from said optical transmission line;

a repeater station provided at one point or more in said optical transmission line; and

pump light sources provided in at least two of said transmitting station, said receiving station, and said repeater station, for supplying pump light to said optical transmission line, and wherein

detecting means provided in a station according to a pumping method of said pump light, for detecting optical power of said optical signal amplified by said pump light; and

stopping means provided in a station supplied with said pump light, for stopping supply of said pump light when a comparison result between first and second detection results is within a predetermined range, the first detection result being obtained by said detecting means when a pump light having a first optical power is supplied to said power transmission line, the second detection result being obtained by said detecting means when a pump light having a second optical power larger than said first optical power is supplied to said optical transmission line.

12. An optical communication system comprising:

a transmitting station;

an optical transmission line for transmitting an optical signal, which has a plurality of wavelength bands and is sent from said transmitting station;

a receiving station for receiving said optical signal outputted from said optical transmission line;

a repeater station provided at one point or more in said optical transmission line; and

pump light sources provided in at least two of said transmitting station, said receiving station, and said repeater station, for supplying a plurality of pump lights in correspondence with said plurality of wavelength bands, to said optical transmission line;

band detecting means provided in a station according to a pumping method of said pump light, for detecting optical power of said optical signal amplified by said pump light in each of said plurality of wavelength bands; and

band adjusting means provided in a station provided with said pump light source, for adjusting optical powers of said plurality of pump lights according to a detection result from said band detecting means so as to keep optical power detected in said each wavelength band within a predetermined fixed range.

13. The optical communication system according to claim 12, wherein:

said plurality of wavelength bands is C-band and L-band; and

said plurality of pump lights has wavelengths of 1440 nm and 1485 nm.

14. The optical communication system according to claim 12, wherein said pump light source is a laser light source which oscillates laser lights with wavelengths of 1440 nm, 1450 nm, and 1485 nm, further comprising

control means provided in a station provided with said pump light source, for controlling said pump light source to output: said laser light with the wavelength of 1450 nm when only said optical signal having the C-band are transmitted; said laser light with the wavelength of 1485 nm when only said optical signal having the L-band are transmitted; and said laser lights with the wavelengths of 1440 nm and 1485 nm when said optical signal having the C-band and the L-band are transmitted.

15. The optical communication system according to claim 12, further comprising:

shielding means provided in said optical transmission line inside a station, for shielding said plurality of pump lights, the station opposing to another station supplied with

said pump lights, and being in a direction that said pump lights transmit from said another station.

16. The optical communication system according to claim 12, further comprising:

residual light detecting means provided in a station opposing to another station supplied with said plurality of pump lights and being in a direction that said pump lights transmit from another station, for detecting optical power of residual pump light of each of said pump lights;

adjusting means provided in a station supplied with said plurality of pump lights, for adjusting optical power of each of said pump lights so that a detection result from said residual light detecting means falls within a predetermined fixed range; and

detection result transmitting means for transmitting said detection result from said residual light detecting means to said adjusting means.

17. The optical communication system according to claim 12, further comprising:

residual light detecting means provided in a station opposing to another station supplied with said plurality of pump lights, and being in a direction that said pump lights transmit from another station, for detecting optical power of residual pump light of each of said pump lights;

stopping means provided in a station supplied with said plurality of pump lights, for stopping supply of said pump lights when a detection result from said residual light detecting means is equal to or lower than a predetermined value; and

detection result transmitting means for transmitting said detection result from said residual light detecting means to said stopping means.

18. The optical communication system according to claim 12, further comprising:

optical signal detecting means provided in a station supplied with said plurality of pump lights, for detecting optical power of said optical signal; and

stopping means for stopping supply of said plurality of pump lights when a detection result from said optical signal detecting means is outside a predetermined fixed range.

19. The optical communication system according to claim 12, further comprising:

reflected light detecting means provided in a station supplied with said plurality of pump lights, for detecting optical powers of reflected pump lights of said plurality of pump lights; and

stopping means for stopping supply of said plurality of pump lights when a detection result from said reflected light detecting means is equal to or higher than a predetermined value.

20. A method for supplying pump light used for Raman amplification in an optical transmission line, comprising:

a first step of supplying pump light having a first optical power to said optical transmission line;

a second step of detecting optical power of light Raman-amplified by said pump light having said first optical power;

a third step of supplying pump light having a second optical power larger than said first optical power, to said optical transmission line;

a fourth step of detecting optical power of light Raman-amplified by said pump light having said second optical power; and

a fifth step of giving a warning about anomaly occurring at a supplying destination of said pump light when a comparison result between detection results of the second step and the fourth step is within a predetermined range.

21. The method according to claim 20, further comprising a step of stopping supply of said pump light when said warning is given.

22. A method for supplying pump light used for Raman amplification of an optical signal

having two wavelength bands in an optical transmission line, comprising:

a first step of supplying a first pump light at a predetermined value to said optical transmission line, the first pump light exciting an optical signal having a first wavelength band;

a second step of detecting optical power of said optical signal having said first wavelength band;

a third step of detecting optical power of an optical signal having a second wavelength band different from said first wavelength band; and

a fourth step of adjusting a second pump light so that both detection results of said second and third steps fall within a predetermined fixed range, the second pump light exciting said optical signal having said second wavelength band.

23. A distributed Raman amplifying apparatus, wherein:

a plurality of pump lights is supplied from at least two points in an optical transmission line, which transmits an optical signal; and

said plurality of pump lights has two types or more of wavelength.